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EFFECT OF MODIFIED ATMOSPHERE PACKAGES ON QUALITY OF SNAP BEANS

BY

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ABSTRACT

Snap bean seeds cv polista was sown on 3 rd of March during the two successive summer seasons of 2003 and 2004 at the Experimental Station, Faculty of Agriculture, Cairo Univ. Giza, Egypt. to study the effect of modified atmosphere packages on quality of snap bean during the storage.

Snap bean pods were packed in two types of polyethylene film bags (high and low density) with 16,and 32 μ thickness for high density and 32 and 64μ for low density, besides carton boxes (control treatment) were used, and the pods were stored at 8°c and 96% RH. the samples were taken after 0, 4, 7, 11, 14 and 18 days of storage.

The obtained results indicate that snap bean pods packed in 32 μ high density sealed had greater chlorophyll content contributing to greener appearance, ascorbic acid, lowest percentages of decay, weight loss and fiber, which mean the best quality, on the other hand, the control treatment showed the lowest appearance and quality.

Key words: snap bean; MAP; storage periods; decay; weight loss; chlorophyll; fiber; T.S.S; carbohydrate.

INTRODUCTION

Snap bean (*Phaseolus vulgaris* L.) is one of the most important vegetable crops grown in Egypt for local consumption, processing and export especially during the period from October to May.

The quality and shelf-life of snap bean is related to cultivars, handling and to all the biochemical processes which take place during post harvest (Sistrunk *et al.*, 1989). Respiration induces heat emission, with a temperature increase, which affects metabolic processes and induces an acceleration of decay phenomena. Modified atmosphere packaging (MAP) utilizes polymeric films of differential permabilities to O_2, CO_2, C_2H_2 and water vapor to extend the shelf-life of various fruits and vegetables. Atmospheric modification within a package develops as a result of the respiration rate of the plant tissue and gas diffusion characteristics of the film (Kader *et al.*, 1989). Low temperature storage when resulted in reducing respiration and ethylene production rates, retarded softening, and slowing down of compositional change associated with ripening and senescence (Wills *et al.*, 1981; Zagory and Kader, 1989; O'Beirne, 1991).

Certain physical and chemical attributes of snap beans are used often as indicators of quality. These include percentage of seed by weight, resistance to shear, fiber content, ascorbic acid content and percent of soluble solids (Guyer *et al.*, 1950; Gonzalez *et al.*, 1989; Sistrunk *et al.*, 1989). Loss of moisture leads to loss of weight and crispness during storage (Parker and Stavart, 1935; Guyer *et al.*, 1950; Sistrunk *et al.*, 1989).

Buscher and Adams, (1979). Stated enhancement of carbon dioxide levels from respiration of beans held in sealed bags was apparently sufficient to prevent decreasing quality. Groeschel *et al.* (1966) Showed that 5-10% carbon dioxide retarded yellowing. Polyethylene bags were used to prevent water loss and retain total sugars (Sistrunk *et al.*, 1989).

The aim of this work was to determine the effect of modified atmosphere packaging on quality, shelf –life, and chemical composition of fresh snap bean.

MATERIALS AND METHODS

1: plant materials:

This study was conducted at the Experimental Station, Faculty of Agriculture, Cairo University, Giza, Egypt. The soil of the experimental area was loamy clay. The soil chemical and physical analysis are presented in table (A).Seeds of snap bean cv. Polista were sown on 3 rd of March during the two successive summer seasons of 2003 and 2004. The ridges 4-m long and 0.7-m wide. Seeds were sown on one side of the ridge and spaced 15 cm within each row in three replicates using standard commercial practices. Pods were harvested at the proper stage of maturity by hand on the 7th of May during both season and immediately stored at 8°c (ideal temperature) to maintain the nutritive value (Torija Isasa *et al.*, 1997) and 95% relative humidity. This was done in California laboratory, Faculty of Agriculture, Cairo University to reduce the field temperature and after 24 hours of storage, the pods were cleaned and uniformity classified according to size, length and color.

2: Experimental procedures:

Snap bean pods were stored in low or high density polyethylene bags of different thicken. Each experimental unit consisted of 250g of pods. A completely randomize design with 3 replicates was used

Treatments were follow:

1-16μ high density polyethylene sealed (MAP-1)
2- 32μ high density polyethylene sealed (MAP-2)
3- 16μ high density polyethylene open (MAP-3)
4- 32μ low density polyethylene sealed (MAP-4)
5- 64μ low density polyethylene sealed (MAP-5)
6- 32μ low density polyethylene open (MAP-6)
7- carton boxes used as a control treatment.

The package was 19.5×17.5 cm in size and the sealed package were heat - sealed. The water vapor transmission rate was 239g/m^2/24h., 12g/m^2/24h., 10g/m^2/24h. and 5g/m^2/24h. for MAP-1, MAP-2, MAP-5 and MAP-6 respectively.

Table (A): Physical and chemical analysis of the soil at the experimental sites.

	2003	2004
	a- Physical analysis	
Soil texture	Clay	Clay
Clay (%)	22.9	26.1
Silt (%)	36.2	34.6
Fiue sand(%)	37.1	36.0
Coarse sand(%)	3.8	3.3
	b-Chemical analysis	
Ca^{++} meq/L	7.00	7.22
K^+ meq/L	0.28	0.33
Na^+ meq/L	6.20	6.00
Mg^{++} meq/L	3.00	2.88
Cl^- meq/L	3.60	3.70
Co_3^{--}+Hco_3^- meq/L	10.50	10.28
So_4^{--} meq/L	2.38	2.45
P (ppm)	22.03	20.0
N ppm	32.0	28.0
Fe ppm	1.16	1.09
Zn ppm	0.30	0.48
Mn ppm	0.54	0.64
Cu ppm	0.65	0.42
Ec (mmohs/cm)	1.61	1.65
PH	8.03	7.89

3: Assessment and measurement.

Samples were taken after 0,4,7,11,14 and 18 days of storage to measure the following characters:

3.1-Physical properties:

3.1.1-Weight loss (%):

Weight loss percentage was estimated according to the following equation :

$$\text{W.L.} = \frac{\text{Initial weight of pods} - \text{weight of pod at sampling date}}{\text{Initial weight}} \times 100$$

3.1.2-Decay(%):

Decayed pods (shrieked, injured, shriveled, and spoiled pods) were removed, weighted, recorded and calculated using the same equation of weight loss.

3.1.3- Dry matter:

Snap bean pods were dried at 70c° for three days and then weighted to calculate dry weight

3.2: Chemical properties:

3.2.1 Fiber %: Fiber % was determined as mentioned in Official Methods of Analysis of Agriculture Chemist as method described in (A.O.A.C.1980)

3.2.2-Total soluble solids (T.S.S): T.S.S were determined by using Zeiss laboratory refractometer.

3.2.3- Chlorophyll a, b, total chlorophyll and carotenids: were determined using the methods mentioned by (Nornai 1982).

3.2.4- Ascorbic acid content (vitamin c):

Vitamin c was measured by titration with 2-6-dichloronid phenol according to method mentioned in (A.O.A.C.1980)

3.2.5-Total hydrolysable carbohydrates: Were determined as methods mentioned in (A.O.A.C.1980)

Statistical analysis:

Data were organized in a completely randomized block design (CRBD) with three replications. the analysis of variance (ANOVA) were obtained using M.Statc statistical software.

RESULTS AND DISCUSSION

Tables (1,2 and 3) shows the effect of modified atmosphere packaging, storage periods and their interaction in both seasons on some physical and chemical properties of snap bean pods.

Weight loss (%):

Table (1) Showed that the control treatment had higher weight loss than all other tested treatments at different storage periods from 0 to 18 days. On the other hand, the treatment of MAP- 64µ low density sealed showed the lowest weight loss percentage compared to all other treatments at the same storage periods in both seasons.

Concerning the effect of storage periods on weight loss percentage, data in Table (2) show that weight loss of pods was gradually increased with increasing the storage period. With respect to the effect of the interaction between the storage periods and modified atmosphere packaging on the weight loss percentage.data in Table (3) shows that at different storage periods, the treatment of MAP-64µ low density sealed was the lowest treatment in weight loss compared to all other tested treatments during both seasons of study. These results indicats that the MAP had a significant effect on decreasing weight loss of pods. This reduction of weight loss was due to the polyolefin film packaging which did not allow water to evaporate or transpirate from the pods, this agrees with results reported by Risse and Craig, 1989; Trail *et al.*, 1992; Cano *et al.*, 1997; Mekwatanakarn *et al.*, 1997; Pariasca *et al.*, 2000 and Deell and Toivonen, 2000.

Decay % :

Data presented in Tables (1 and 3)shows that the control treatment was significantly higher in decay percentage compared to all other tested treatments in both seasons at the different storage periods, followed by the treatment of MAP-

64μ low sealed, whereas, the treatment of MAP 32μ high sealed had the lowest percentage.This result indicates that the MAP-64μ low sealed saves a higher water content than all other treatments, which mean a higher risk of microbial contamination. It is clear from data presented in Table (2) that the decay percentage of pods was increased with prolongation of the storage periods. The decay started slowly and successively increased till the end of storage. This was a result of the changes occurred in pods during storage, which caused an increase of moisture condensation on external surface of pods,which decrease pod firmness, as well as, the transformation of complex compound to simple forms of more liability to fungus infection. These results are in agreement with (Silva *et al.*, 1999; Fallik *et al.*, 2002; Vander Steen *et al.*, 2002; Jinhe bai *et al.*, 2003 and Ji Gang Kim *et al.*, 2004).

Dry matter:

Tables (1 and 3) indicate that the control treatment had the highest value of dry matter compared to all other treatments, followed by the treatment of 16μ high open at both season. These results are due to the rate of moisture loss, which mean the control treatment had the lowest pod moisture content as compared to all other treatments. Data presented in Table (2) indicate that the dry matter was increased with the prolongation of storage periods. This is due to the higher rate of moisture loss through transpiration than that of dry matter loss through respiration. These results in agreement with El-sheikh, 1979 and El- shikh and Salah 1998.

Fiber (%):

The fiber content of snap bean had adverse effects on the pod quality. In this respect, the control treatment had the highest significant fiber content over all MAP treatments while the treatment of MAP 32μ high sealed showed the lowest value as compared to all other tested treatments at all storage periods in both seasons of study. Tables (1 and 3). It is clear from data in Table (2) that the fiber content was increased with prolongation of storage periods, and reached its maximum peak at the end of storage, this may be due to moisture loss during storage. These results agree with El-sheikh and Salah, 1998; Sanchez Mata *et al.*, 2003. On the other hand Trail *et al.*, 1992 found that storage periods had no significant effect on fiber content.

Total soluble solids (T.S.S):

The treatment of MAP 32μ high sealed had the highest T.S.S value compared to all treatments followed by the treatment of MAP 16μ high sealed, whereas, the control treatment showed the lowest value Tables (1 and 3). Data presented in Table (2) indicates that T.S.S in pods decreased with increasing the storage periods. The reduction in T.S.S during storage could be due to respiration processes which involve a high consumption of simple sugars, and other degradation processes which are intensified during the later stages. This could explain the noticeable decrease of total soluble sugars during the latter days of storage. Similar results were obtained by El-sheikh 1979; Trail *et al.*, 1992; El-seifi 1997 and El-sheikh and Salah 1998 and disagree with Freeman and Sistrunk 1978 who reported an increase in soluble solids as storage period extended, the disagreement between the result of this research and the previous researches may have been due to retention of moisture from packaging.

Table (1): Effect of modified atmosphere packages on some physical and chemical properties of snap bean pods during 2003 and 2004 seasons

MAP	Weight loss %	Decay %	Dry matter %	Fiber %	T.S.S	Chlorophyll A mg/g fw	Chlorophyll B mg/ g fw	Total chlorophyll mg/g fw	Carotenids mg/g fw	V.C mg/100g fw	Total Hydrolysable Carbohydrate g/100g dw
	2003 season										
16µ High Sealed	2.279	3.544	7.009	9.631	5.083	9.791	6.092	15.85	3.004	18.02	12.60
32µ High Sealed	1.951	2.817	6.566	9.247	5.250	10.20	6.829	16.97	3.350	18.17	13.32
16µ High Open	2.594	5.014	7.267	10.03	4.472	9.541	5.933	15.47	3.044	17.81	14.18
32µ Low Open	2.369	5.083	7.125	9.961	4.583	8.974	5.815	14.79	2.707	17.63	14.05
32µ Low Sealed	1.971	5.506	6.646	9.981	4.389	9.225	6.638	15.86	2.989	17.53	12.72
64µ Low Sealed	1.413	6.472	6.247	9.789	4.167	8.962	6.286	15.25	2.732	17.52	12.29
Control	3.082	8.139	7.901	10.68	4.611	6.822	7.667	14.55	2.696	17.18	13.19
L.S.D.(0.05)	0.225	0.508	0.180	0.104	0.270	0.344	0.360	0.538	0.124	0.250	0.483
	2004 season										
16µ High Sealed	1.320	5.511	7.080	10.34	4.472	9.972	6.492	16.46	3.145	15.43	11.55
32µ High Sealed	1.226	4.039	6.492	10.05	4.639	10.38	6.627	17.00	2.812	15.50	12.66
16µ High Open	1.759	7.367	7.206	10.70	4.222	9.638	6.278	15.88	2.908	15.31	13.36
32µ Low Open	1.285	7.628	6.689	10.90	4.250	9.108	5.856	14.96	2.875	15.17	13.62
32µ Low Sealed	1.060	7.078	6.554	10.70	4.028	8.516	6.445	14.89	2.921	14.97	11.36
64µ Low Sealed	0.957	7.933	6.426	10.86	3.556	7.765	6.193	13.84	2.869	14.80	11.57
Control	3.149	10.06	8.496	11.44	3.972	7.178	5.543	12.72	2.745	14.48	13.67
L.S.D.(0.05)	0.116	0.403	0.889	0.118	0.257	0.483	0.440	0.554	0.163	0.235	0.123

Table (2): Effect of storage periods on some physical and chemical properties of snap bean pods during 2003 and 2004 seasons.

Storage periods (Days)	Weight loss %	Decay %	Dry matter %	Fiber %	T.S.S	Chlorophyll A mg/g fw	Chlorophyll B mg/g fw	Total chlorophyll mg/g fw	Carotenids mg/g fw	V.C mg/10g fw	Total Hydrolysable Carbohydrate g/100g dw
2003 season											
0	0.000	0.000	4.840	7.752	5.810	11.48	7.855	19.34	3.635	20.82	16.29
4	1.282	0.000	6.065	8.730	5.381	10.33	7.230	17.54	3.342	-----	15.49
7	1.932	2.507	6.681	9.640	4.952	9.687	6.880	16.52	3.089	18.35	13.88
11	2.703	5.310	7.381	10.41	4.286	8.792	6.181	14.97	2.860	-----	12.76
14	3.407	9.733	8.085	11.11	4.048	7.525	5.673	13.20	2.447	13.91	11.24
18	4.098	13.80	8.743	11.76	3.429	6.622	4.976	11.64	2.187	-----	9.500
L.S.D.$_{(0.05)}$	0.209	0.471	0.167	0.097	0.250	0.319	0.333	0.498	0.114	0.163	0.447
2004 season											
0	0.000	0.000	5.552	8.638	5.619	11.82	6.520	18.34	3.385	18.47	15.90
4	0.832	0.000	6.330	9.733	4.571	9.235	6.962	16.10	3.098	-----	15.22
7	1.430	4.219	6.884	10.45	4.238	9.887	7.128	16.91	3.167	15.21	13.52
11	1.849	8.424	7.282	11.18	3.929	8.787	6.061	14.85	2.764	------	11.85
14	2.321	12.54	7.712	11.80	3.405	7.749	5.469	13.22	2.637	11.60	10.15
18	2.788	17.00	8.191	12.47	3.214	6.140	5.089	11.23	2.326	------	8.587
L.S.D.$_{(0.05)}$	0.108	0.373	0.082	0.109	0.238	0.447	0.411	0.513	0.151	0.154	0.114

Table (3): **Effect of modified atmosphere packages , storage periods and their interaction on some physical and chemical properties of snap bean.**

2003 season												
MAP	Storage periods (Days)	Weight loss %	Decay %	Dry matter %	Fiber %	T.S.S	Chlorophyll A mg/g fw	Chlorophyll B mg/g fw	Total chlorophyll mg/g fw	Carotenids mg/g fw	V.C mg/10g fw	Total Hydrolysable Carbohydrate
16µ High Sealed	0	0.000	0.000	4.833	7.767	6.000	12.10	6.723	18.82	3.857	20.83	15.52
	4	1.293	0.000	6.083	8.443	5.667	11.30	6.967	18.08	3.435	-----	14.71
	7	1.913	0.000	6.660	9.390	5.667	10.46	6.663	17.12	3.213	18.87	13.36
	11	2.740	3.200	7.447	10.11	4.667	9.780	5.743	15.52	2.916	-----	12.20
	14	3.567	6.667	8.233	10.74	4.662	8.087	5.690	13.78	2.397	14.37	10.92
	18	4.160	11.40	8.800	11.33	3.833	7.017	4.767	11.78	2.205	-----	8.917
32µ High Sealed	0	0.000	0.000	4.713	7.667	6.000	11.97	7.720	19.69	3.929	20.90	16.28
	4	1.057	0.000	5.710	8.107	6.000	11.21	7.997	19.21	3.691	-----	15.60
	7	1.683	0.000	6.310	9.013	5.656	11.04	6.927	17.63	3.484	18.90	14.10
	11	2.340	2.300	6.933	9.707	5.000	9.853	7.047	16.90	3.303	-----	12.70
	14	2.997	5.567	7.563	10.27	4.667	9.083	5.960	15.04	2.987	14.70	11.66
	18	3.630	9.033	8.167	10.72	4.167	8.040	5.323	13.36	2.703	-----	9.613
16µ High Open	0	0.000	0.000	4.833	7.900	5.667	11.80	7.553	19.35	3.753	20.90	17.03
	4	1.533	0.000	6.297	9.147	5.000	10.91	6.770	17.68	3.487	------	16.31
	7	2.137	3.150	6.870	9.830	4.636	10.14	6.173	16.31	3.224	18.40	14.78
	11	3.323	5.033	7.767	10.53	4.000	9.143	5.600	14.74	2.945	-----	13.86
	14	3.883	8.900	8.533	11.09	4.000	7.923	5.033	12.96	2.628	14.13	12.58
	18	4.590	13.00	9.300	11.67	3.500	7.330	4.467	11.80	2.226	-----	10.49
32µ Low Open	0	0.000	0.000	4.867	7.667	5.667	10.97	7.577	18.54	3.282	20.70	17.13
	4	1.377	0.000	6.183	9.033	5.333	9.800	6.663	16.46	3.057	------	16.30
	7	1.953	2.533	6.733	9.823	5.000	9.369	5.917	15.28	2.888	18.23	14.91
	11	2.903	5.500	7.633	10.47	4.000	8.847	5.400	14.25	2.649	------	13.71
	14	3.570	9.267	8.267	11.07	4.000	7.810	4.900	12.71	2.283	13.97	11.99
	18	4.410	13.20	9.067	11.71	3.500	7.053	4.433	11.47	2.084	------	10.26

Continue Table (3)

MAP	Storage periods (Days)	Weight loss %	Decay %	Dry matter %	Fiber %	T.S.S	Chlorophyll A mg/g fw	Chlorophyll B mg/g fw	Total chlorophyll mg/g fw	Carotenids mg/g fw	V.C mg/10g fw	Total Hydrolysable Carbohydrate
32µ Low Sealed	0	0.000	0.000	4.767	7.800	6.000	11.90	7.607	19.51	3.519	20.70	15.63
	4	1.067	0.000	5.787	8.676	5.333	10.55	6.713	17.26	3.218	------	14.86
	7	1.850	2.767	6.529	9.650	4.333	9.850	7.297	17.15	2.994	18.27	13.45
	11	2.443	5.267	7.097	10.47	4.000	8.987	5.493	14.48	2.976	------	12.54
	14	2.933	10.73	7.567	11.24	3.667	7.350	6.703	14.05	2.822	13.63	10.51
	18	3.533	14.27	8.133	11.97	3.000	6.717	6.017	12.73	2.407	------	9.350
64µ Low Sealed	0	0.000	0.000	4.900	7.633	5.667	11.70	7.660	19.36	3.580	20.83	15.43
	4	0.7233	0.000	5.593	8.433	4.637	10.26	6.380	16.64	3.329	------	14.48
	7	1.257	3.933	6.100	9.333	4.333	9.653	6.823	16.48	3.056	18.37	13.16
	11	1.563	6.900	6.390	10.33	4.000	8.767	6.103	14.86	2.734	------	12.16
	14	2.170	12.00	6.967	11.15	3.322	7.057	6.043	13.10	2.006	13.37	10.31
	18	2.763	16.00	7.533	11.85	3.000	6.333	4.707	11.04	1.688	------	8.180
Control	0	0.000	0.000	4.967	7.833	5.667	9.933	10.15	20.08	3.521	20.90	17.00
	4	1.927	0.000	6.803	9.177	5.367	8.300	9.117	17.43	3.174	------	16.19
	7	2.730	5.167	7.567	10.44	5.000	7.300	8.357	15.66	2.767	17.43	13.37
	11	3.607	8.967	8.400	11.28	4.333	6.167	7.880	14.05	2.499	------	12.16
	14	4.730	15.00	9.467	12.23	4.000	5.367	5.380	10.75	2.220	13.20	10.74
	18	5.500	19.70	10.20	13.11	3.000	3.867	5.12	9.330	1.993	------	9.687
L.S.D.$_{(0.05)}$		0.553	1.247	0.441	0.256	0.661	0.844	0.882	1.319	0.303	0.433	1.184
						2004 season						
16µ High Sealed	0	0.000	0.000	10.11	8.300	5.667	11.83	7.120	18.95	3.657	18.43	14.23
	4	0.670	0.000	10.74	9.203	4.676	10.59	6.507	17.10	3.302	------	13.45
	7	1.050	0.000	11.33	10.13	4.531	11.58	7.313	18.90	3.524	15.57	12.04
	11	1.560	6.200	7.667	10.82	4.333	9.900	6.500	16.40	3.086	------	10.56
	14	2.060	10.47	8.107	11.44	3.883	8.253	6.087	14.34	2.753	12.30	9.873
	18	2.580	14.00	9.013	12.14	3.667	7.693	5.427	13.10	2.549	------	9.130
32µ High Sealed	0	0.000	0.000	9.707	8.367	6.000	12.00	7.027	19.03	3.168	18.33	15.27
	4	0.520	0.000	10.27	9.137	5.000	10.76	6.543	17.31	2.859	------	14.49
	7	0.890	0.000	10.72	9.820	4.767	11.83	7.857	19.66	3.072	15.70	13.57
	11	1.500	4.967	7.900	10.44	4.333	10.58	6.910	17.49	2.817	------	12.52
	14	2.033	8.167	9.147	10.94	4.000	9.217	6.210	15.43	2.615	12.47	10.66
	18	2.410	11.10	9.830	11.58	3.833	7.863	5.213	13.08	2.342	------	9.480

Continue Table (3)

MAP	Storage periods (Days)	Weight loss %	Decay %	Dry matter %	Fiber %	T.S.S	Chlorophyll A mg/g fw	Chlorophyll B mg/g fw	Total chlorophyll mg/g fw	Carotenids mg/g fw	V.C mg/10g fw	Total Hydrolysable Carbohydrate
16µ High Open	0	0.000	0.000	10.53	8.33	5.667	12.17	6.540	18.71	3.388	18.57	16.13
	4	1.117	0.000	11.09	10.07	4.766	10.37	6.610	16.53	3.106	-----	15.44
	7	1.583	4.800	11.67	10.50	4.000	11.37	7.540	18.67	3.305	15.50	13.97
	11	2.053	8.933	7.667	11.15	4.000	9.000	6.333	15.33	2.769	------	12.90
	14	2.673	12.93	9.033	11.80	3.500	8.070	5.623	13.69	2.619	11.87	11.71
	18	3.127	17.53	9.823	12.34	3.500	6.857	5.473	12.33	2.261	------	9.997
32µ Low Open	0	0.000	0.000	10.47	8.867	5.667	11.30	6.097	17.40	2.952	18.57	16.23
	4	0.9167	0.000	11.07	10.15	4.666	8.070	6.027	14.10	2.717	------	15.59
	7	1.247	5.533	11.71	10.82	4.333	10.82	6.737	17.56	3.357	15.30	14.70
	11	1.517	9.033	7.800	11.31	4.000	9.120	5.590	14.71	2.714	------	13.65
	14	1.850	13.63	8.676	11.84	3.333	8.473	5.287	13.76	2.784	11.63	11.72
	18	2.180	17.57	9.650	12.42	3.500	6.867	5.400	12.27	2.724	------	9.726
32µ Low Sealed	0	0.000	0.000	10.47	8.800	5.766	12.33	5.960	18.29	3.636	18.47	16.17
	4	0.6733	0.000	11.24	9.567	4.667	9.073	7.763	16.84	3.312	------	15.32
	7	1.077	4.800	11.97	10.29	4.000	8.883	7.087	15.52	2.958	15.10	12.37
	11	1.253	8.067	7.633	11.14	3.833	7.797	6.473	14.27	2.738	------	10.58
	14	1.490	12.60	8.433	11.89	3.000	7.103	6.100	13.20	2.698	11.33	8.173
	18	1.867	17.00	9.333	12.51	3.000	5.907	5.287	11.19	2.184	------	5.542
64µ Low Sealed	0	0.000	0.000	10.33	8.967	5.333	11.53	6.197	17.73	3.489	18.43	16.27
	4	0.486	0.000	11.15	9.733	4.000	8.347	7.583	15.24	3.275	------	15.76
	7	0.920	6.467	11.85	10.43	4.000	7.387	6.947	14.33	3.093	14.96	13.07
	11	1.120	9.100	7.833	11.34	3.000	8.150	6.257	14.41	2.645	------	10.46
	14	1.433	13.00	9.177	11.97	2.667	6.590	5.097	11.69	2.643	11.00	7.580
	18	1.783	19.03	10.44	12.73	2.333	4.583	5.080	9.653	2.072	------	6.270
Control	0	0.000	0.000	11.28	8.833	5.333	11.57	6.700	18.27	3.403	18.50	17.10
	4	1.443	0.000	12.23	10.27	4.323	7.433	8.150	15.58	3.119	------	16.37
	7	3.240	7.933	13.11	11.19	4.000	7.333	6.417	13.75	2.860	14.37	14.95
	11	3.940	12.67	0.256	12.04	4.000	6.967	4.367	11.33	2.582	-----	12.30
	14	4.707	16.97	9.953	12.71	3.500	6.533	3.880	10.41	2.351	10.57	11.33
	18	5.567	22.77	10.83	13.59	2.786	3.233	3.743	6.977	2.152	------	9.960
L.S.D.$_{(0.05)}$		0.286	0.989	0.217	0.290	0.631	1.184	1.088	1.359	0.401	0.406	0.302

Chlorophyll a, b, and total chlorophyll content:

The treatment of MAP 32μ high sealed had the highest value of the chlorophyll a, b and total compared with all other tested treatments, On the other hand, the control treatment had the lowest value Tables (1and 3). These results are in agreement with Sahoo and Kulkarni 1999 and Fallik *et al.*, 2002 and disagree with Pala *et al.*, 1994 and Pariasca *et al.*, 2000 who reported that pods stored in MAP-6 had a higher content of chlorophyll.

Loss of chlorophyll was reported to be slowed down in vegetables stored in elevated CO_2 environments. Shewfelt *et al.*, 1986 and Kader *et al.*, 1989 noted that high CO_2 and or low O_2 concentration reduce the break down of chlorophyll to pheophtin, however, Makhlouf *et al.*, 1989 showed that chlorophyll content was maintained in high CO_2

It is obvious from data in Table (2) that chlorophyll a, b and total chlorophyll decreased with prolongation of storage periods.

Caroteniod content:

Data illustrated in Tables (1 and 3) indicate that the treatment of MAP 32 μ high sealed had the highest value compared with all other tested treatments in the first season, while, in the second season the MAP 16μ high sealed treatment had the highest value. The control treatment showed the lowest value compared with all other treatments at both season. It is clear from data in Table (2) that pods caroteniods content decreased with increasing of the storage periods. Similar results were reported by (Cano *et al.*, 1997 and Sanchez *et al.*, 2003) that low levels of O_2 and high CO_2 influence both the reduction of the losses of carotenoids by oxidation and inhabitation of biosynthetic pathways.

Ascorbic acid content:

Ascorbic acid content is often used as an indicator of nutritional quality of snap bean (Guyer *et al.*, 1950). Data presented in Table (1) indicates that the control treatment had the lowest value compared to all other treatments, on the other side, the MAP 32μ high sealed treatment had the highest value in both seasons. Vitamin c degradation is due to enzymatic degradation (ascorbate – oxydase, polyphenol -oxidase, cytochrome – oxidase, peroxidase) Barth *et al.* (1993). Vitamin c was decreased as the storage period increased Table (2). These result agree with (Shewefelt *et al.*,1986; Trail *et al.*, 1992; Torija *et al.*, 1997; Pariasca *et al.*, 2000 and Sanchez *et al.*, 2003).

Total hydrolyzable carbohydrate:

Tables (1 and 3) indicate that the MAP 16μ high open and MAP 32μ low open treatments showed the highest value of carbohydrate at all storage periods compared to all other treatments at the same storage periods. Concerning the effect of storage periods on total hydrolyzable carbohydrate data in Table (2) demonstrates that total hydrolyzable carbohydrate decreased with storage periods increased. The decrease in carbohydrate content during storage might owe much to the utilization of these components through respiration. in addition, the conversion of carbohydrates to other forms of sugars might account much for this observation. These results agree with El-seikh (1979) who reported that carbohydrates content of snap bean pods decreased gradually with the extend of storage period.

CONCLUSIONS.

From the present results, It could be concluded that the best treatment which preserves the nutritive value of snap bean (ascorbic acid, chlorophyll, T.S.S, total hydrolyzable carbohydrate content) was 32μ high density polyethylene sealed.

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تأثير عبوات الجوالهوائي المعدل علي جودة الفاصولياالخضراء

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تم زراعة صنف الفاصوليا بوليستا في ٣ مارس خلال موسمي النمــو٢٠٠٣ و٢٠٠٤ وذلك في محطة التجارب الزراعية بكلية الزراعة- جامعة القاهرة- الجيزة – مصر.وذلك لدراسة تأثير عبوات الجوالهوائي المعدل علي جودة الفاصوليا.

خزنت قرون الفاصوليا في نوعين مختلفين من البولي اثيلين (منخفض وعالي الكثافة) وذلك بسمك ١٦ و٣٢ ميكرون لعالي الكثافة و٣٢ و٦٤ ميكـــرون لمـــنخفض الكثافة بالإضافة إلي معاملة المقارنة وهي (الكراتين) وقد اجري تخزين القرون علـــي درجة حرارة ٨ مئوية ورطوبة نسبية ٩٥% وأخذت العينات بعد فترات تخزينية هـــي صفر، ٤، ٧، ١٤،١١، ١٨ يوم.

تشير النتائج إلي أن قرون الفاصوليا المخزنة في عبوات من البـــولي اثيلـــين عالي الكثافة بسمك ٣٢ ميكرون احتوت علي اعلي كمية كلوروفيل وبالتـــالي أفضـــل مظهر كما إنها احتوت علي اعلي كمية حمض اسكوربيك واقل نسبة في التالف،والفقد في الوزن، الألياف وبالتالي احتفظت الثمار بجودتها طوال فترة التخزين.بينما أظهرت معاملة المقارنة اقل مظهر وجودة.

لوحظ أن هناك زيادة في نسبة فقد الوزن والتالف والألياف ومحتوي القـــرون من المادة الجافة بزيادة فترة التخزين ونقص في كمية الكلوروفيـــل والمـــواد الصـــلبة الذائبة الكلية والكربوهيدرات القابلة للتحلل بزيادة فترة التخزين.

الخلاصة:

ينصح باستخدام عبوة الجوالهوائي المعدل ٣٢ ميكرون عالي الكثافة للحفـــاظ علي جودة الفاصوليا الخضراء.